

Resilience: Modeling for Conditions of Uncertainty and Change

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Based upon Paper presented at Modeling and Simulation World 2014

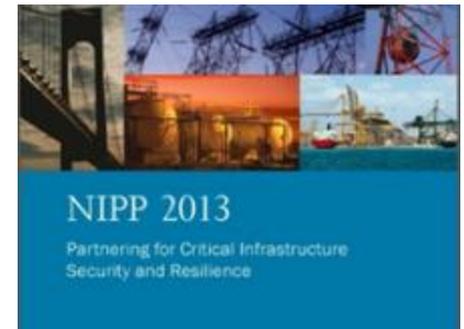
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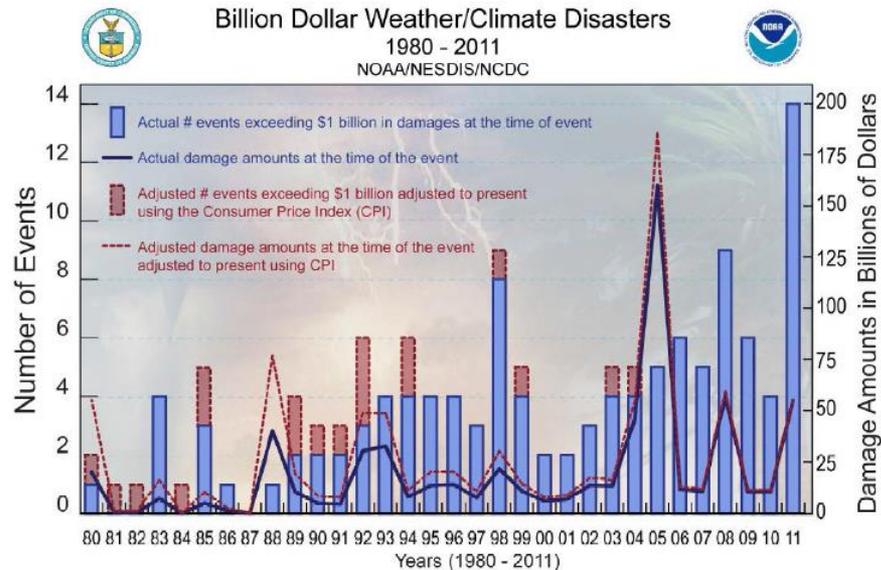
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Dealing with fuzz

- Resilience is the new community risk management concept
- Demands analytical techniques conducive to
 - collaboration,
 - complexity, and
 - uncertainty.
- Solutions may leverage existing civilian and military techniques, but require additional synthesis



Risks are evolving

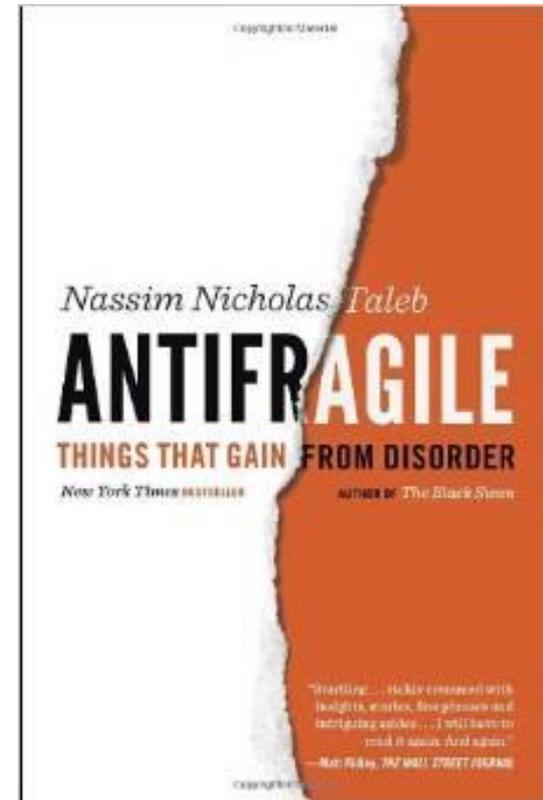


- Natural events increasing in frequency, severity, and impacts
- Human threats (e.g., cyber) proliferating and diversifying
- Long-term changes apparent but complex and unpredictable

Graph source: NOAA National Climatic Data Center, <http://www.ncdc.noaa.gov/billions/>

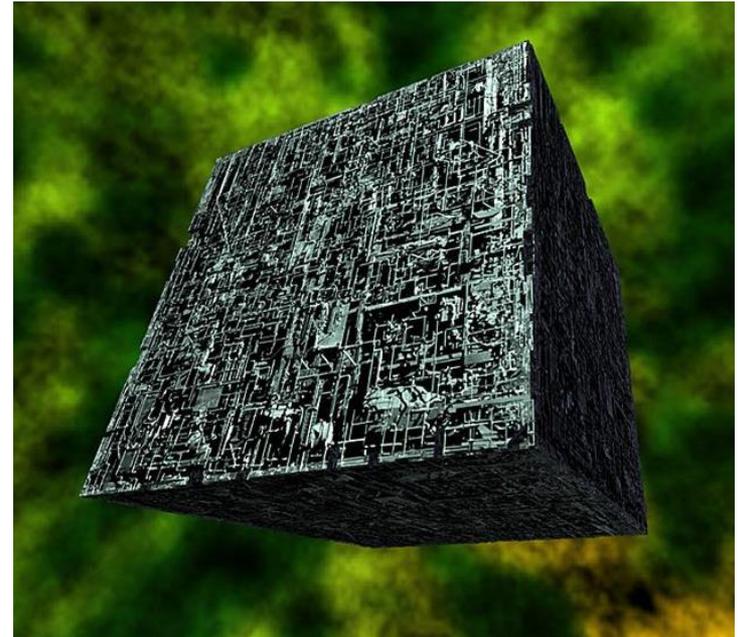
Existing response inadequate

- Systems increasingly optimized for design point performance
- Actuarial methods do not address unknown risks
- Targeted protection vulnerable to evolving threats



Analyzing Resilience

- Holistic orientation
 - Outcome focus regardless of event evolution
 - Interaction among physical, information, human domains
 - Balance robustness, protection, flexibility and readiness
- New analytical techniques required
 - Increased degrees of freedom
 - Interactive systems too complex for deterministic modeling
 - Must integrate qualitative, experimental methods



Star Trek "Borg"

Department of Defense Capabilities Development Process

- Requirements driven by national security responsibilities
- Highly structured process
 - Roles & Responsibilities
 - Logic
 - Standards
 - Analytical methods
- Linked to DoD Resource and Acquisition processes



NSS – National Security Strategy
CONOPS – Concept of Operations
JCIDS – Joint Capabilities Integration & Development System
DOTMLPFP – Doctrine, Organization, Training, Materiel, Leadership & Education, Personnel, Facilities, Policy
POM – Program Objective Memorandum

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Evolution in Military Energy Resilience Guidance

- Existing guidance addresses Critical Infrastructure Protection
 - DODM, DODI, ASA IE&E, IMCOM
- Deputy Under SECDEF directed 'power resilience review' (2014)
 - Adherence to resilience policies, determine gaps, develop remediation plans
- Army ACSIM / CG, IMCOM interview
 - Challenged to address the complexity, enormity and interdependencies of installation energy resilience

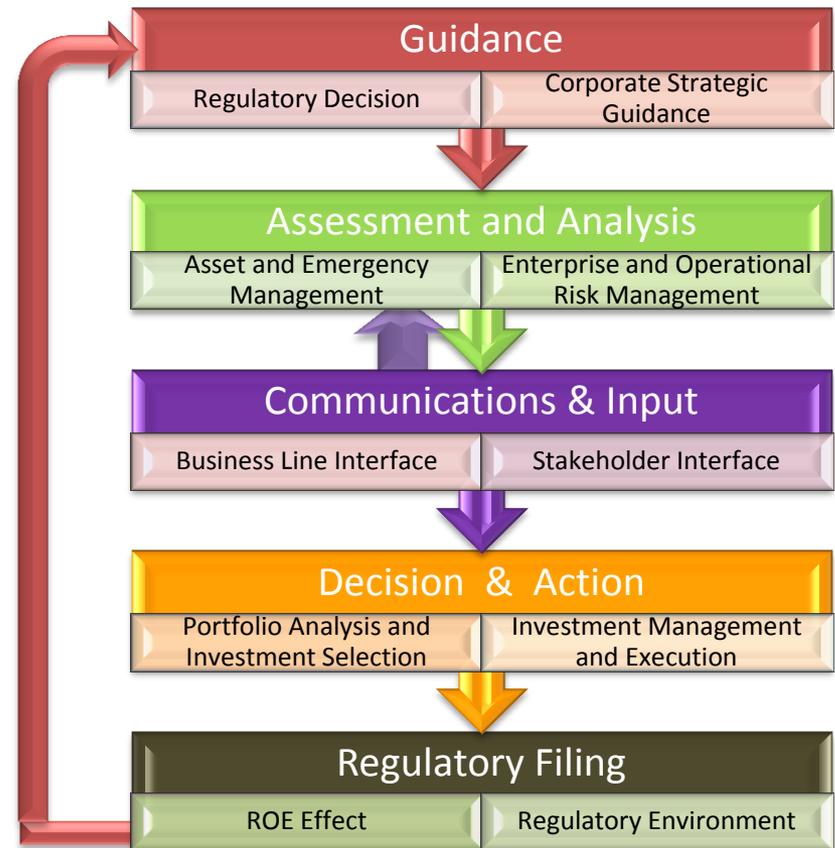


DODM – DOD Memorandum
 DODI – DOD Instruction
 ASA IE&E – Assistant Secretary of the Army, Installations , Energy and Environment
 ACSIM – Assistant Chief of Staff, Installation Management
 CG, IMCOM - Commanding General, Installation Management Command

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Commercial Utility Capabilities Development Process

- Predominantly regulated industry
- Process evolution usually driven by actual or anticipated regulatory action
- Competing priorities
 - Shareholder desires for profitability
 - Rate payer desire for 100% safe, reliable, and resilient service
 - Regulator political implications and compliance issues
 - Constrained resources

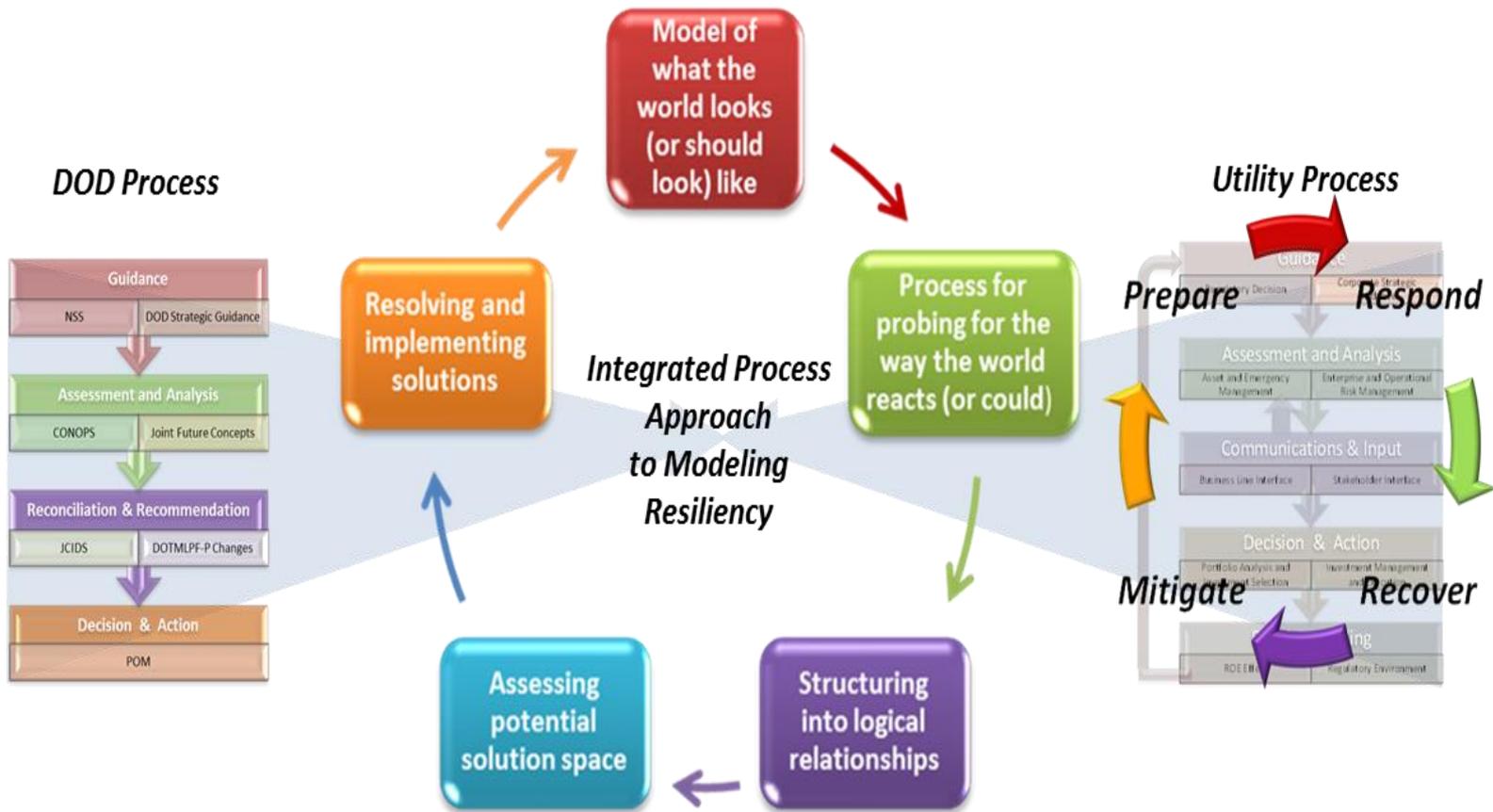


Commercial Utility Temporal Framework

- **Prepare** - Asset management decisions and investment in response capabilities
- **Respond** – Processes, procedures and methods to respond to unplanned events
- **Recover** – Leadership and coordination to reestablishing service as quickly as possible
- **Mitigate** – System improvements, procedure changes, coordination and communication based upon lessons learned



Integrated Approach to Energy Resilience M&S



Step 1: Elicit World View

Sources

- Interviews
- Expert models
- Workshops
- Plans
- Studies



Step 2: Characterize System Response

Techniques

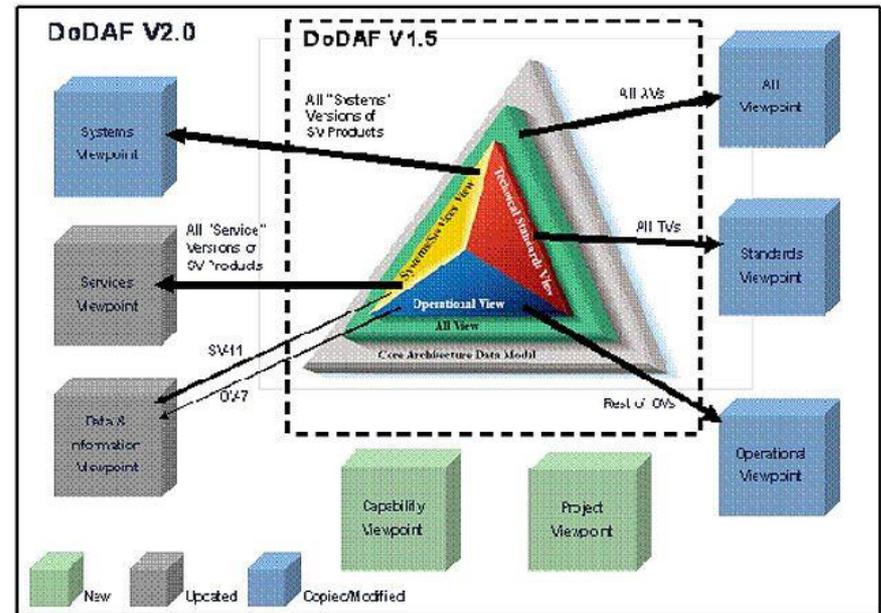
- Experiments
- Tabletop Drills
- Community Exercises
- Wargames



Step 3: Map System Taxonomy

Templates

- National Planning Frameworks
- DoD Architectural Framework
- Temporal Framework
 - ✓ Prepare
 - ✓ Respond
 - ✓ Recover
 - ✓ Mitigate

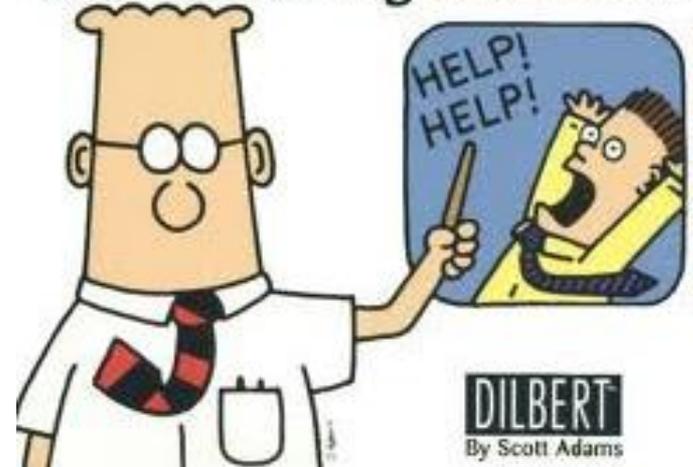


Steps 4/5: Identify/Select Solutions

Tools

- Emergency planning process
- DOTMLPFP
- Collaborative portfolio comparison

Our Disaster Recovery Plan Goes Something Like This...



Conclusions

- Resilience demands conceptual changes
 - System versus protective focus
 - Outcome-oriented metrics
- Expert insights can inform structured methods
 - Characterize complex interactions
 - Examine response to change
 - Test multi-domain portfolio solutions
- Useful structures / techniques available
 - National Planning Frameworks
 - DoD Architectural Framework
 - Scenario-based exercises/games

